CORRECTED REBUTTAL TESTIMONY OF

PETER B. DAVID

ON BEHALF OF

DOMINION ENERGY SOUTH CAROLINA, INC.

DOCKET NO. 2021-88-E

Q. PLEASE STATE YOUR NAME, POSITION, AND BUSINESS ADDRESS.

A. My name is Peter B. David. My business address is 150 N. Riverside Plaza, Suite 2100, Chicago, IL, 60606.

Q. ARE YOU THE SAME PETER DAVID THAT OFFERED DIRECT TESTIMONY IN THIS DOCKET?

A. Yes, I am.

Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY?

A. The purpose of my rebuttal testimony is to discuss the response of Dominion Energy South Carolina, Inc. ("DESC" or the "Company") to certain issues raised in 1) the direct testimony of Mr. Ed Burgess filed on behalf of the Carolinas Clean Energy Business Association ("CCEBA"); and 2) the direct testimony of Mr. Brian Horii filed on behalf of the South Carolina Office of Regulatory Staff ("ORS"). The lack of a response to any of the specific assertions made by these witnesses does not constitute the Company's agreement to those assertions.

REBUTTAL TO TESTIMONY OF MR. ED BURGESS

Q. WITH RESPECT TO MR. BURGESS'S TESTIMONY, PLEASE EXPLAIN HOW YOU ORGANIZE YOUR RESPONSES.

A. My rebuttal testimony sequentially addresses certain issues raised by Mr. Burgess as they appear in his direct testimony.

Q. ON PAGE 7 MR. BURGESS STATES THAT GUIDEHOUSE RESULTS ARE A "ROUGH APPROXIMATION OF POSSIBLE OPERATING CONDITIONS ON THE DESC SYSTEM." DO YOU AGREE?

A. I disagree with the notion that Guidehouse results are only a "rough approximation" of the Company's operating conditions. As discussed in my direct testimony, for more than 10 years Guidehouse (and its predecessor, Navigant) has maintained a Reference Case forecast for all ISOs, RTOs, and NERC sub-regions that is updated twice a year. This forecast is conducted on a nodal basis, representing the entire transmission footprint in addition to generation, and incorporates near and long-term outlooks on demand and energy growth, generator additions and retirements, fuel prices, emissions prices, federal and state regulations, and transmission infrastructure investment. This forecast is regularly used by a wide array of different market participants, including both developers and utilities, for projects involving resource planning, asset valuation, and renewable integration. Furthermore, Guidehouse has a well-earned reputation for providing an

independent, thorough, and detailed forecast of North American energy markets. Additionally, Guidehouse incorporated insights from DESC's most recent Integrated Resource Plan ("IRP") as well as detailed plant operating parameters for plants operated by the Company in order to model the DESC system as accurately as possible. Thus, to call Guidehouse's approach a "rough approximation" entirely mischaracterizes the entire field of production cost modeling and ignores the care, due diligence, research, and professional analysis undertaken by Guidehouse under my direct supervision to develop the Variable Integration Cost Study presented as Exhibit No. ___ (PBD-2) ("VIC Study") in my Direct Testimony.

Q. ON PAGE 7, MR. BURGESS STATES THAT GUIDEHOUSE'S MODEL INPUTS "GROSSLY MISREPRESENT DESC'S ACTUAL OPERATING PRACTICES" AND, AS A RESULT, GUIDEHOUSE'S MODELED INTEGRATION COSTS ARE SIGNIFICANTLY INFLATED. HOW DO YOU RESPOND TO THIS POSITION?

A. I disagree with this unfounded and incorrect assertion. As discussed in my previous response, Guidehouse worked closely with DESC to verify the operating parameters for all of the generation assets and used DESC's published IRP in order to accurately model annual peak demand, annual energy usage, and long-term capacity additions and retirements. In addition to verifying that all generating assets are represented correctly within the model, Guidehouse also underwent a rigorous benchmarking exercise in order to achieve near-term forecast dispatch results that

follow trends observed in recent historical dispatch in order to ensure that the model is appropriately synced with the Company's actual operations. Thus, contrary to "grossly misrepresenting" DESC's operating practices and thereby "significantly inflating" DESC's integration cost, the facts demonstrate that Guidehouse's modeling accurately reflects the operating parameters of DESC's system, resulting in an accurate and fair determination of actual costs experienced by DESC to integrate the various tranches of solar generation on its system today and expected in the future.

Q. IN MULTIPLE INSTANCES IN HIS TESTIMONY, MR. BURGESS CRITICIZES THE USE OF MODELED RESULTS INSTEAD OF DESC'S ACTUAL INTEGRATION COSTS. ON PAGE 8 MR. BURGESS WRITES THAT "DESC ALREADY HAS CONSIDERABLE EXPERIENCE OPERATING ITS SYSTEM WITH THESE RESOURCES" BECAUSE MORE THAN 80% OF THE TRANCHE 1 SOLAR CAPACITY IS ALREADY ONLINE. ON PAGE 9 HE REPEATS THAT DESC SHOULD BE ABLE TO TRACK THE INCREASED OPERATING RESERVE REQUIREMENTS AND ASSOCIATED COSTS WITH INTEGRATING SOLAR BECAUSE IT HAS "HAD OVER 2 YEARS TO COLLECT DATA ON INTEGRATION COSTS INCURRED DUE TO SOLAR ABOVE THE BASELINE LEVEL OF 340 MW." HOW DO YOU RESPOND TO THIS?

A. The costs associated with integrating higher levels of solar penetration are directly related to the increased operating reserve requirements that are driven by solar forecast uncertainty. An attempt to tie the long-term cost of integrating solar capacity to what the Company has observed over the last two years is misguided for several reasons.

First and foremost, Guidehouse's modeled variable integration cost ("VIC") for the different tranches of solar penetration in the study is based on what operating reserve requirements should be, not what they have been in the past. The operating reserve levels that DESC has required in recent history have been lower than what Guidehouse recommends; consequently, there would be significant differences between the actual costs incurred by DESC for integrating solar over the last two years versus what those costs may have been with a more appropriate operating reserve requirement.

Second, the fact that DESC has not had an event in these last two years in which the amount of available operating reserves was insufficient is not evidence that Guidehouse's recommended operating reserve requirement is too high or otherwise unreasonable. Two years is a relatively small sample size; as indicated in my response to question 10 from CCEBA's second request for records in this docket, the 90th percentile event around which Guidehouse defined its operating reserve requirements is one that is very unlikely to occur regularly but can be reasonably expected to occur at least once during the 10-year forecast period. Thus

it is unsurprising and not statistically meaningful that no such event occurred during a single two-year period.

Third, attempting to tie the future costs for integrating solar capacity, including capacity that has already come online over the last two years, to costs previously incurred to integrate solar capacity naively disregards the ways in which both the Company's and neighboring balancing authorities' ("BAs") systems are expected to evolve in the future. The VIC proposed by Guidehouse is a net present value ("NPV") that is levelized across 10 forecast years. Driven by changes in the generation landscape, the costs associated both with producing power within the DESC service territory and purchasing power to import from neighboring BA's will shift dramatically. As a result, the costs in 2025, for example, associated with integrating existing solar capacity will be significantly different than the costs that may have already been incurred to integrate that capacity. In sum, though, for the current proceeding, the VIC Study presents the costs of integrating the various tranches of solar generation into DESC's system and represents the values that Guidehouse recommends be set to ensure that the costs associated with integrating solar is borne by the cost-causers and not DESC's other customers.

Q. ON PAGES 11-12 MR. BURGESS CLAIMS THAT GUIDEHOUSE "SIGNIFICANTLY OVERESTIMATED THE INTEGRATION COSTS INCLUDED IN THE VIC" BECAUSE THE OPERATING RESERVE REQUIREMENT THAT GUIDEHOUSE MODELED IS GREATER THAN

THE COMPANY'S SYSTEM OPERATORS HAVE REQUIRED. AS SUPPORT HE INCLUDES A CHART SHOWING THE DIFFERENCE BETWEEN THE OPERATING RESERVES AS MODELED BY GUIDEHOUSE VERSUS THOSE CURRENTLY HELD BY DESC, AND CLAIMS THAT THE DIFFERENCE DISPLAYED IS PROOF THAT THE GUIDEHOUSE STUDY IS FLAWED. DO YOU AGREE?

A. I disagree that Guidehouse's study is flawed or that I have overestimated the integration costs included in the VIC. As previously discussed in this testimony, the Guidehouse study is based on what operating reserve requirements should be, not what they have been in the past. Based on the thorough analysis and modeling performed in the Study, DESC has informed Guidehouse that it is taking the VIC Study's recommendations for operating reserve levels under advisement. Therefore, the fact that operating reserve levels included in this study are greater than what DESC currently maintains is immaterial and this criticism has no merit.

Q. ON PAGES 12-13 MR. BURGESS INDICATES THAT HE DOES NOT KNOW WHETHER THE COMPANY'S CURRENT PRACTICE OF HOLDING INCREMENTAL OPERATING RESERVES EQUAL TO 40% OF EXPECTED SOLAR GENERATION IS APPROPRIATE. HOW DO YOU RESPOND TO THIS?

A. Mr. Burgess's admission that he does not know whether or not the Company's current practices with respect to operating reserve requirements is

appropriate simply proves he is guessing because he has not performed the modeling necessary to offer an opinion that is informed by and based upon rigorous analysis. Moreover, his admission invalidates every argument he levies with respect to the operating reserve requirements modeled by Guidehouse. Mr. Burgess attempts to soften this by claiming that it is possible that the 40% of expected solar generation level of operating reserves employed by DESC is appropriate or it is possible that it is higher than is necessary; however, he leaves unstated that it is also possible, and in fact likely based on Guidehouse's modeled results, that the current level of operating reserves that the Company requires is too low. In sum, Mr. Burgess offers no evidence that the operating reserve requirements as modeled by Guidehouse are too high beyond the observation that they are higher than the level that DESC currently requires. However, given that Guidehouse modeled what the operating reserve requirement should be rather than what it has been in the past as previously discussed, and that Mr. Burgess admits that he does not know what the appropriate level of operating reserve requirements should be, his claim that the operating reserve requirements as modeled by Guidehouse are too high is meritless and should be disregarded.

Q. ON PAGES 14-16 MR. BURGESS DISCUSSES THE FACT THAT DESC HAS HISTORICALLY HAD AVERAGE AVAILABLE OPERATING RESERVES IN EXCESS OF WHAT GUIDEHOUSE'S STUDY DETERMINED IS REQUIRED TO INTEGRATE EACH TRANCHE OF

SOLAR PENETRATION. MR. BURGESS THEN ARGUES THAT THE COST TO INTEGRATE SOLAR SHOULD BE "ESSENTIALLY ZERO". DO YOU AGREE?

A. I disagree with the conclusions drawn by Mr. Burgess here. Mr. Burgess specifically references the average amount of operating reserves available on the Company's system in recent years; however, the operating reserves available in any given hour can and do vary significantly from the overall monthly average. Contrary to what Mr. Burgess states, it is absolutely normal in both the historical and forecast operations to experience available operating reserves significantly exceeding the minimum reserve requirement. Moreover, the need for increasing the minimum operating reserve requirement in order to integrate solar capacity is not in any way driven by the average values that Mr. Burgess points to but rather by the relatively small number of hours in which available operating reserves are close to the minimum requirement.

Mr. Burgess references Guidehouse's modeling of the Baseline scenario that includes the current 250 MW operating reserve requirement; he then argues that, while 250 MW is the minimum requirement, it is far below the level of reserves that are typically available on the Company's system and that the Guidehouse VIC analysis may be misrepresenting how the Company's system is operated if the operating reserves available in the baseline analysis are close to the minimum requirement. However, as Mr. Burgess has seen in the ~~"Guidehouse VIC Calculation Workbook" Excel files for each solar tranche that were provided in~~

~~response to ORS request for records 1-4~~Excel workbook files provided in response to CCEBA request for records 2-14, his statement flagrantly misrepresents how Guidehouse modeled the Company's system. As shown in these workpapers, Guidehouse's analysis shows DESC carrying available operating reserves in significant excess of the baseline 250 MW requirement in most hours; the cost to integrate solar capacity for each tranche is driven by the need to increase available operating reserves in the relatively small number of hours in which the Company does not carry an excess in the Baseline scenario and the ways in which overall system dispatch must change in other hours in order to accommodate those changes.

In sum, Mr. Burgess's recommendation of zero for the VIC is simply expressing what his client wishes the VIC to be, but is not evidence of what the VIC actually is. Thus, his musing about the appropriate level of operating reserves should be disregarded as providing proof of nothing other than Mr. Burgess just simply does not know, as he candidly admits.

Q. ON PAGE 18 MR. BURGESS DISCUSSES WAYS IN WHICH THE GUIDEHOUSE STUDY IMPROVED UPON SOME DEFICIENCES IDENTIFIED IN THE PRIOR STUDY CONDUCTED IN 2019. WHAT IS YOUR POSITION?

A. Mr. Burgess notes in this section that "in the present case, it appears that DESC has assumed additional reserve requirements equal to a more balanced 90th percentile of instances with a drop in solar generation, rather than the extreme 100th

percentile they assumed in 2019." I agree with Mr. Burgess that the 90th percentile of instances with a drop in solar generation is a balanced approach; as a result of this balanced approach Guidehouse has produced a reasonable forecast for minimum operating reserve requirements and thus a reasonable analysis of the VIC associated with integrating solar capacity on the Company's system.

Q. ON PAGES 17-19 MR. BURGESS IDENTIFIES WHAT HE BELIEVES ARE SEVERAL OTHER DEFICIENCIES IN GUIDEHOUSE'S STUDY. DO YOU AGREE WITH MR. BURGESS'S FINDINGS?

A. I disagree with each of the issues that Mr. Burgess has labeled as a deficiency. In this response I will go through each one individually.

- Mr. Burgess states that, in the 2019 study, "The modeled solar output profile overestimated volatility and only partially accounts for the effects of geographic diversity, thus inherently overestimating integration costs." He claims that he cannot determine whether or not that issue has been corrected in this study "because DESC's workpapers provided to date do not contain critical information on how the incremental reserve requirements were determined based on the solar volatility profiles." In the "Guidehouse Flexibility Reserves Requirement Workbook" Excel files that were provided to CCEBA (and referenced on page 19 of Mr. Burgess's testimony), the full set of data that Guidehouse used to calculate the incremental operating

reserve needs is included. These files show National Renewable Energy Laboratory ("NREL") simulations of both 5-minute actual generation and 4-hour ahead hourly scheduled solar generation from a wide array of solar sites across the Company's footprint. This data includes latitude and longitude coordinates for all of the NREL solar sites that were considered as well as the corresponding coordinates for the existing and in-development solar facilities across DESC. This data demonstrates that the impact of geographic diversity on solar forecast error and corresponding operating reserve requirement needs were considered appropriately. Mr. Burgess also registers a complaint that the workpapers provided did not include formulas; as specifically indicated in prior responses, no such formula workbooks exist as Guidehouse employed a VBA-based model to conduct Monte Carlo draws to compare the actual generation data to the scheduled data. All of the solar forecast, generation, and locational data that Guidehouse used to conduct these Monte Carlo simulations has been provided.

- Mr. Burgess also repeats in this section his criticism that the minimum operating reserve requirements as modeled by Guidehouse are greater than those that have been required by the Company in recent history. Mr. Burgess again points to the fact that, in recent history, DESC's operating reserve requirement associated with solar penetration has been equal to 40% of expected solar generation and claims that, in this study, Guidehouse and DESC "inexplicably assumes that incremental reserves equal to 60% of solar

generation are needed to avoid a reserve shortfall." First, as previously discussed, Guidehouse's analysis is based on what Guidehouse calculated the operating reserve requirement should be, not what DESC has historically held. Second, the statement that this study used the assumption that incremental operating reserves should be equal to 60% of solar generation is an inaccurate description of how this study was conducted. Guidehouse did not attempt to match the operating reserve requirement to a specific level of solar capacity or generation; rather, as previously discussed, Guidehouse rigorously modeled what the minimum operating reserve requirement should be for each level of solar penetration. The 60% value that Mr. Burgess refers to is simply a conservative estimate of maximum potential shortfall of solar generation based on the modeled incremental increase in operating reserve requirements. It is not used in any calculations to determine the VIC; it is only used to show illustrative examples of when there may be operating reserve shortages due to solar generation shortfall if the Company's minimum operating reserve requirement is not increased from its current 250 MW level.

- Mr. Burgess discusses the adjustments that Guidehouse made in the benchmarking process to define specific pumping and generating hours for the Fairfield pumped hydro facility as well as the fact that the facility is modeled as being able to provide operating reserves only when generating and not when offline or pumping. Mr. Burgess claims that, in modeling the

Fairfield pumped hydro facility as described, Guidehouse has restricted its ability to provide operating reserves in a way that invalidates the VIC study. This claim fundamentally misrepresents both how this study was conducted and how a production cost model such as PROMOD works. There are three important facts that contradict Mr. Burgess's claims:

- The fact that Guidehouse defined specific hours in which the Fairfield pumped storage asset can (but does not have to if market conditions do not require it) either pump or generate does not prevent the asset from providing operating reserves when needed. The vast majority of solar generating hours, including each of the sample hours with potential operating reserve shortages due to solar shortfall shown in table 13 of Exhibit No. ___ (PBD-2), are hours in which the pumped storage asset can generate and thus provide operating reserves if required. The fact that the pumped storage asset is not generating, and thus not providing operating reserves, in those hours is not due to the way in which the Fairfield pumped storage asset's pumping and generating hours are defined, but rather due to the fact that the economic solution does not support the asset generating in those hours, and, with the baseline reserve requirement, it is not needed for operating reserves in those hours either.
- The Fairfield pumped storage asset's ability to provide operating reserves when offline or pumping driven by its ability to switch to

generation mode in less than 15 minutes in real world operations depends on factors such as reservoir level that are impossible to predict over the long term without first conducting the modeling exercise. For example, it would be unreasonable to model the asset as being able to provide operating reserves during an hour in which it is not generating if the reservoir was empty or the facility was otherwise not actually capable of generating.

- Mr. Burgess's claims that the Fairfield pumped storage facility is not being properly utilized to provide operating reserves because it is modeled as only being able to provide operating reserves when it is already generating misrepresents how the asset is actually modeled within PROMOD. Other assets that can provide "quick-start reserves,"[1] namely gas combustion turbines ("CTs"), have significant costs associated with generating from both fuel and non-fuel variable operations and maintenance ("VOM") as well as costs associated with starting up; if those assets were only able to provide operating reserves when already online, and not quick-start reserves, it would significantly impact the forecast dispatch as PROMOD would need to account for those costs as well as other operating restrictions, such as minimum generation levels and minimum up and down times, in order

[1] "Quick-start reserves" here are defined as operating reserves provided by assets that are not online but are capable of starting up and syncing with the grid within 15 minutes

to have those assets online to provide operating reserves. Conversely, the Fairfield pumped storage facility is modeled with no variable costs, no start costs, minimum up and down times of only 1 hour, and a minimum generation level of only 0.1% of its maximum capabilities; so long as the reservoir is filled to a sufficient level and the asset is otherwise available (i.e. not offline due to planned maintenance), PROMOD can turn it on immediately in order to provide operating reserves at a level up to 99.9% of its maximum capability whenever necessary. Fairfield can provide operating reserves when it is economic to do so, subject to this *de minimis* operating expense. The model chooses other sources of operating reserves because they result in lower system costs. Thus, there is no merit to the claim that my analysis restricts Fairfield's ability to provide operating reserves.

- Mr. Burgess again claims that "DESC did not properly account for geographic diversity of solar resources on its system." As I established earlier in my testimony, the study does explicitly account for geographic diversity. Mr. Burgess's claim regarding geographic diversity not being properly accounted for is in reference to the workpapers showing the risk of solar shortfall provided in response to CCEBA request for records 2-14. Mr. Burgess claims that the 60% solar shortfall included in these workbooks implies that "DESC is incorrectly assuming that a 60% drop in solar

production could occur simultaneously across all facilities, which is statistically a virtual impossibility." The quoted statement by Mr. Burgess is a gross misinterpretation of the data provided. The 60% drop in solar production does not represent a scenario in which every single facility's production simultaneously drops 60%; rather, it represents a scenario in which the production from a select group of facilities drops to or close to 0 while the rest are entirely unaffected, and the missing generation from those specific facilities represents 60% of the total expected solar generation on the system. Further, Mr. Burgess's claim that "any unexpected drop in a single facility is not likely to be correlated with other facilities" is only partially correct; the Company covers a relatively small service territory,[2] and thus the impact of geographic diversity on this study is somewhat limited, and while an unexpected drop in a single facility is indeed unlikely to be correlated with drops at *all* facilities within the Company's service territory, it is highly likely to be correlated with drops at other nearby solar facilities. Guidehouse's study does not make any claims as to which specific solar facilities may experience unexpected drops at any given time, but rather determines through extensive analysis that the sum total of missing

[2] DESC's service territory covers roughly 16,000 square miles. For comparison, that is 33% smaller than its neighboring BA, Duke Energy Carolinas, which covers roughly 24,000 square miles, and 80% smaller than the roughly 80,000 square miles covered by another nearby service territory, the Tennessee Valley Authority.

generation from the facilities that do experience drops could be as high as 60% of the total solar generation expected on the system.

Q. ON PAGES 21-22, MR. BURGESS DISCUSSES WHAT HE BELIEVES IS AN ERROR IN THE ANALYSIS RELATED TO THE WEIGHTING OF INTEGRATION. WHAT IS YOUR RESPONSE?

A. Mr. Burgess is correct that the original plan for the analysis was to weight the integration costs by the hourly solar generation. However, he is incorrect that the lack of weighting in the final analysis (beyond the binary weighting based on whether or not there is any solar generation in the hour) is erroneous. While I considered the merits of weighting by solar production, in the final analysis I ultimately concluded an unweighted average better reflected the costs to the system. However, in the description of the weighting included in my direct testimony, I inadvertently did not update it to reflect the correction to the weighting.

Mr. Burgess levies several criticisms based on the Company's response to ORS request for records 3-1b, all of which are without merit and should be rejected. First, he discusses the explanation that integration costs in low solar (i.e. early morning or late evening) hours are influenced by macro-level changes in operations driven by the increased operating reserve requirement high solar (i.e. midday) hours and states "even if this were true it is not sufficient to explain an equal weighting during all morning hours." Mr. Burgess's claim here is false.

When PROMOD solves for the optimal dispatch of the system, the amount of operating reserves it will force a system to hold depends solely on the conditions defined for that specific scenario and not anything related to a previously analyzed scenario. As has been previously discussed in this testimony, the fact that available operating reserves during the vast majority of early morning low solar hours when modeled with the baseline requirement exceed the increased operating reserve requirement that Guidehouse calculated does not mean that modeling the increased minimum operating reserve requirement will cause PROMOD increase the available operating reserves in those hours. Rather, the operating constraints modeled for thermal generators, such as start costs and minimum up and down times, imply that changes in dispatch (and thus changes in system costs) in all hours due to an increased operating reserve requirement are driven by the need to procure additional reserves during gross peak hours that correspond with high solar output during the middle of the day. Therefore, weighting the change in system costs in an early morning low solar hour by the level of solar generation in that same hour is inappropriate.

Mr. Burgess also levels a similar criticism to the lack of weighting during late afternoon and early evening hours, stating that "this principle would not apply in the afternoon or evening since there is no need for incremental reserves to be held after sunset." Mr. Burgess is correct that there is no need for incremental reserves for integrating solar capacity to be held after sunset; nevertheless, his criticism here is unfounded. First, again driven by the operating constraints modeled for thermal

generators, dispatch decisions in the late afternoon and early evening hours can be influenced by system needs both earlier in that day and the next day. Considerations of minimum up and down times and start costs can lead to a thermal generator being online late in the evening when the economics of the hour don't necessarily support it being online. Why? Because either the resource was needed earlier in the day and cannot shut down yet due to minimum up time constraints, or it will be needed the next day coupled with the operator's knowledge that the amount of money it will lose operating uneconomically overnight is less than the charges it will incur for a startup the next day. It is likely that increased costs in most or all overnight non-solar hours are driven by the need to procure additional operating reserves during gross peak midday hours; nevertheless, I conservatively excluded those hours from the study. Therefore, weighting the change in system costs in a late afternoon or evening low solar hour by the level of solar generation in that same hour is also inappropriate.

Lastly, Mr. Burgess references the Company's explanation that the potential for solar forecast error as a percentage of expected solar generation is greater during low solar hours than high solar hours. Mr. Burgess attempts to refute this point by claiming "the percent error is completely irrelevant to the total MW of reserves needed to accommodate any shortfall – what matters is the MW magnitude, duration, and unexpectedness of the shortfall." While Mr. Burgess is correct that the magnitude and duration of an unexpected shortfall are the important factors here, his criticism misses the mark. First of all, because the forecast error as a percentage

of expected solar generation is greater during low solar hours than high solar hours, the magnitude and duration of a potential solar shortfall is not significantly reduced during low solar hours. Secondly, and more importantly, as previously discussed, the increase in system costs during low solar hours is driven by macro-level changes to overall system dispatch and not the need to meet increased operating reserve requirements in those hours, so the operating reserve requirement in those specific hours being potentially too high is immaterial to the analysis.

Q. ON PAGES 22-23, MR. BURGESS CLAIMS THAT THE VIC THAT GUIDEHOUSE CALCULATED FOR TRANCHE 1 IS INAPPROPRIATELY INFLATED BECAUSE IT ALLOCATES INTEGRATION COSTS ACROSS ONLY GENERATION FROM THE 633 MW OF SOLAR CAPACITY INCLUDED IN TRANCHE 1 AND NOT ANY OF THE GENERATION FROM THE 340 MW OF BASELINE SOLAR. DO YOU AGREE?

A. I disagree with Mr. Burgess's assertion that any of the costs to integrate the Tranche 1 solar capacity should be allocated to the 340 MW of baseline solar facilities. Mr. Burgess writes that "DESC's model evaluates the incremental cost of Operating Reserves necessary to support the full 973 MW of solar." While this is technically correct, Mr. Burgess incorrectly implies that the incremental increase in operating reserve requirements is based on going from 0 MW of solar penetration to 973 MW. In reality, the incremental increase in operating reserves calculated for this scenario were based on increasing solar penetration by 633 MW (i.e. the size of

tranche 1) with no opinion taken or analysis done on what the appropriate level of operating reserves should be for the 340 MW of baseline solar penetration. Thus, when Mr. Burgess writes that "presumably at least some of the incremental integration costs in the 973 MW scenario are attributable to the initial 340 MW of solar generation included in the Baseline tranche," he is mistaken. All of the incremental increases in minimum operating reserve requirements incorporated in this study, and thus all of the incremental increases in system costs, are attributable specifically to the Tranche 1 solar capacity.

Q. ON PAGE 23, MR. BURGESS IDENTIFIES A FORMULA ERROR IN THE WORKPAPERS PROVIDED IN RESPONSE TO CCEBA REQUEST FOR RECORDS 2-14. HOW DO YOU RESPOND?

A. Mr. Burgess is correct that there is a spreadsheet error that impacts the reported potential operating reserve shortfall in the 2029-31 timeframe. However, while we regret this error, it is entirely immaterial to the analysis. It neither influences the reported VIC nor impacts the illustrative examples of potential reserve shortfalls shown in table 13 of Exhibit No. ___ (PBD-2). While Guidehouse and DESC can provide a corrected workbook if requested, it has no bearing whatsoever on the overall analysis.

Q. ON PAGES 23-24 MR. BURGESS REFERENCES THE MW OF POTENTIAL RESERVE SHORTFALLS SHOWN IN TABLE 13 OF

EXHIBIT NO. ___ (PBD-2) AS WELL AS THE WORKPAPERS PROVIDED IN THE COMPANIES RESPONSE TO CCEBA REQUEST FOR RECORDS 2-18. HE CLAIMS THAT, SINCE THE RESERVE SHORTFALLS ARE LESS THAN THE RECOMMENDED INCREMENTAL INCREASE IN OPERATING RESERVES, THAT GUIDEHOUSE'S MODELED INCREMENTAL INCREASE IN OPERATING RESERVES IS INFLATED. DO YOU AGREE?

A. I disagree with the conclusion that Mr. Burgess has drawn here. Once again, Mr. Burgess is fundamentally misrepresenting the way that a production cost model such as PROMOD operates. He fails to recognize that an increase in the incremental operating reserve requirement is fundamentally different than an increase in available operating reserves. The fact that the reserve shortfalls when the system is modeled with the baseline 250 MW minimum operating reserve requirement are less than the required incremental increase in operating reserves as modeled by Guidehouse does not mean that the incremental increase in operating reserves is too great. As has been previously discussed and just like in DESC's actual operations, the operating reserve requirement modeled in PROMOD is the *minimum* amount operating reserves the Company must hold but the actual amount of operating reserves available in any given hour is often substantially greater.

As an example, Mr. Burgess points to the fact that "the highest level of shortfall in the scenario without incremental reserves was 151 MW (for October). This is approximately half of the 299 MW in assumed incremental reserve needs

Guidehouse assumed for Tranche 1 in that month." However, what he fails to mention is that the hourly data in the workpapers provided in response to CCEBA request for records 2-14 shows the amount of available operating reserves and the risk of reserve shortfall in every hour of the forecast. The 151 MW shortfall value for October that he references occurs on 10/9/2027 hour ending 16; while the reserve shortfall of 151 MW is approximately half of the 299 MW increase in incremental operating reserves for the month as suggested by Guidehouse, Mr. Burgess fails to note that the system is already carrying 498 MW of available operating reserves at that hour (not including 100 MW of interruptible load).

As previously noted in this testimony, if I run a baseline scenario in PROMOD and then run a second scenario with increased operating reserve requirements but no other input assumption changes, the increased operating reserve requirement scenario will not simply show available operating reserves in any hour as being equal to the sum of the available operating reserves in that hour in the baseline case and the increased operating reserve requirement. Instead, as in real world operations, the PROMOD solution will simply change so that minimum amount of operating reserves available in any hour is at least equal to the increased reserve requirement; in any hour in the baseline solution in which the available operating reserves exceed the minimum operating reserve requirement in the increased reserve case there is no need for the PROMOD dispatch to change in that hour to accommodate that hour's increased operating reserve requirement. In other words, if the analysis were conducted with the operating reserve requirement in

October increased from 250 MW by only 151 MW, the minimum operating reserve requirement in that hour of 401 MW would still be less than 498 MW of available operating reserves in the baseline reserve scenario and thus there's no reason to believe that it would not still result in the same level of potential reserve shortfall.

Q. ON PAGES 24-26, MR. BURGESS PROVIDES A SUMMARY OF WHAT HE IDENTIFIES AS DEFICIENCIES OR ERRORS IN THE GUIDEHOUSE ANALYSIS. DO YOU AGREE WITH HIS FINDINGS?

A. I disagree with each of the issues that Mr. Burgess claims to be deficiencies or errors in the analysis. Many of the issues presented in the table on pages 24-25 of Mr. Burgess's testimony have already been discussed in this rebuttal and thus do not need to be repeated; several have not, so I will rebut them here.

First, Mr. Burgess claims that, in both the current analysis and the prior study conducted in 2019, Guidehouse modeled DESC as an "islanded system" because it cannot procure operating reserves from external resources. This criticism is inaccurate in two ways. Firstly, DESC was not modeled as an islanded system in either the 2019 study or the current one, and it is objectively false to state otherwise. As mentioned in my direct testimony, Guidehouse modeled the entire Eastern Interconnect on a fully nodal basis (i.e. a full representation of the transmission landscape) for the duration of the forecast period. The Company can and does trade energy with its neighboring BAs as needed subject to interface limits and economic hurdle rates. As shown in response to CCEBA request for records 1-3b, the

Company's system was modeled with the ability to import (or export) up to 9,172 MW per hour from its neighboring BAs, a value that significantly exceeds its net peak demand in any forecast year. Secondly, criticizing the analysis for not allowing DESC to procure operating reserves from external resources is unfounded because it does not match the Company's actually operations. In real world operations, DESC must supply all of its own operating reserves. The VACAR reserve sharing agreement under which DESC must maintain 200 MW of contingency reserves does not imply that DESC can share all operating reserve requirements with its neighbors; rather, it is to account for one single specific possible contingency that could affect all BAs in VACAR. DESC must hold that 200 MW of contingency reserves from its own resources, and like its neighboring BAs it must hold its other required balancing and load following reserves from its own resources as well. What DESC can do, both in actual operations and as modeled for this study, is import energy from neighboring BAs as necessary (subject to interface limits and economic hurdle rates) if it has to hold back generation from its own flexible resources to provide operating reserves when it would otherwise use those resources for energy. The claims that DESC is modeled as an islanded system and that its inability to procure reserves from external resources is erroneous are both wrong.

Second, Mr. Burgess claims that it is inappropriate to compare the actual solar generation against a 4-hour ahead schedule of solar generation, rather than a shorter-term look ahead such as 1-hour, in order to calculate the potential solar forecast error. This criticism is based upon a combination of Mr. Burgess's

misrepresentation of the Company's operations and flawed logic. Insofar as misrepresenting the Company's operations, Mr. Burgess writes "as described in DESC's response to ORS 3-3, the Company's system operators hold 'operating reserves in the amount of 40% of the hourly solar forecast' (emphasis added [by Mr. Burgess]). This implies that the Company actually uses a 1-hour solar forecast, rather than a 4-hour forecast." This does not by any means imply that the Company actually uses a 1-hour solar forecast rather than a 4-hour forecast; rather, "hourly" in this instance clearly refers to the granularity of the data (i.e. production expected for an entire hour, not more granular 5 or 15 minute intervals) and not the look ahead time. In reality, DESC receives a single hourly schedule of expected solar generation from each facility owner at the beginning of the day. This means that, in actual operations, by the middle of the day DESC's schedule for expected solar generation is actually greater than 4 hours old. Second, Mr. Burgess does provide evidence by way of a recent analysis published by NREL indicating that "a 1-hour forecast is superior to a 4-hour forecast since it is closer in time to real-time operations." While this is true, his claim that "the sole reason Guidehouse used a 4-hour forecast in its modeling is the fact that this is the only publicly available forecast data available" is not. Guidehouse did not consider a shorter duration look-ahead forecast from another vendor because it would not appropriately match actual DESC operations. Guidehouse does not disagree with the conclusion that using a 1-hour ahead forecast of solar generation rather than a 4-hour ahead forecast in comparison against actual generation would produce significantly less forecast

error, but that reasoning does not mean that it would be appropriate to use for this study. First, while the solar forecast error may be reduced using a 1-hour ahead forecast rather than a 4-hour ahead forecast, the operating reserve requirement would not necessarily be reduced; referring to the rebuttal testimony filed on behalf of the Company by Thomas E. Hanzlik, in order to react to unexpected drops in solar generation the Company needs to be able to plan its thermal generator dispatch and that requires more than a 1-hour look ahead in order to be done effectively. Secondly, as mentioned above, DESC receives a single hourly schedule of expected solar output from facility owners at the beginning of each day, so by the middle of the day the look-ahead is considerably more than 4 hours. Using 1-hour ahead scheduled solar generation rather than 4-hour ahead in this analysis would have reduced what Guidehouse modeled as the incremental increase in operating reserve requirements for each tranche of solar, but it would not have matched actual DESC operations and would have significantly underestimated the potential solar shortfall that DESC has to account for. It is incumbent upon the solar asset owners to provide DESC with more granular and/or frequent data than they currently do in order to reduce the potential for forecast error and thus reduce the Company's minimum operating reserve requirements and solar integration costs.

Lastly, the final supposed deficiency that Mr. Burgess identifies is that Guidehouse did not include in its study intra-hour dispatch improvements via a mechanism such as the Southeast Energy Exchange Market ("SEEM") or some other regional imbalance market. I disagree that the lack of including SEEM in this

analysis is a deficiency or error. Guidehouse models the world as it is, not as it may be, and pays very close attention to potential market changes. Guidehouse has actively analyzed SEEM on behalf of a number of stakeholders in the southeast and is fully aware of all progress made towards its implementation. With its judgment having been fully informed by these past analyses of SEEM, Guidehouse's position is that currently SEEM is too speculative to include in our Reference Case forecast or this study.

Q. ON PAGE 27 MR. BURGESS CLAIMS THAT "A VIC OF $0/MWH IS APPROPRIATE." DO YOU AGREE?

A. I disagree with Mr. Burgess's conclusion. He claims that DESC has not provided sufficient evidence to justify an increase in the VIC due to "the many errors and deficiencies in DESC's analysis." Throughout this rebuttal testimony, I have responded to every single supposed error or deficiency in Guidehouse's work in this case that Mr. Burgess has identified and have thoroughly explained how none are actually errors or deficiencies. In summary, the criticisms are either misplaced, incorrect, or just flat wrong, and do not provide any evidence that the VIC should be set at zero. This statement is simply what Mr. Burgess's clients wish, and is advanced without any meaningful analysis to support the recommendation as reasonable. More to the point, Mr. Burgess is recommending that the cost of integration be shifted to retail customers rather than being borne by his clients who cause the integration costs.

Q. ON PAGE 28 MR. BURGESS RECOMMENDS THAT, IF THE COMMISSION FEELS COMPELLED TO APPROVE A NON-ZERO VIC, THE VIC FOR TRANCHE 1 FACILITIES BE SET TO $0.28/MWH; ON PAGES 29-30 MR. BURGESS DETAILS THE MODIFICATIONS HE BELIEVES SHOULD BE APPLIED TO THE GUIDEHOUSE STUDY TO ACHIEVE THT NUMBER HOW DO YOU RESPOND TO THIS?

A. Mr. Burgess's suggested corrections to the VIC study are all without merit and should be rejected. The "corrections" that Mr. Burgess claims should be applied are all to address supposed deficiencies that, as I have discussed, are not actually deficiencies.

The first change that Mr. Burgess suggests making is to allocate the changes to production costs from the Tranche 1 analysis in the "with reserves case" as compared to the "without reserves" case across all 973 MW of solar capacity included in that analysis instead of excluding the 340 MW of baseline solar capacity and allocating the costs across 341-973 MW of solar penetration that makes up the tranche. As previously discussed, that would be an inappropriate change. The focus of the analysis of this tranche was strictly the 633 MW of solar capacity designated as making up this tranche; the increased incremental operating reserves modeled for this scenario was calculated to account for this specific tranche of solar penetration.

The second change that Mr. Burgess suggests making is to weight the hourly change in production cost by the level of solar generation in that hour. However,

that would also be an inappropriate adjustment. As previously discussed, changes in operating costs during low solar hours are not related to increasing the available operating reserves in those hours due to the fact that the available operating reserves in those hours (both in recent history and in the forecast) tend to exceed the increased operating reserve requirement even when the requirement is set to the 250 MW baseline level. Rather, changes to operating costs during these hours are related to macro-level system dispatch changes needed to optimize the dispatch in order to maintain the increased level of operating reserves needed during high solar hours. Therefore, the change in system costs with increased operating reserve requirements versus without in low solar hours are not related to the amount of solar generation in that hour specifically, and thus weighting costs by the level of solar generation in any hour is inappropriate.

The third change that Mr. Burgess recommends is to adjust the analysis to account for calculating operating reserve needs by comparing actual solar generation to a 1-hour ahead forecast instead of the 4-hour ahead forecast that was used. This suggestion is flawed for 3 important reasons. Firstly, Mr. Burgess again incorrectly claims that DESC receives a 1-hour ahead forecast of generation from solar facilities and that the Guidehouse analysis should have used a 1-hour ahead forecast to match. As previously discussed, this claim from Mr. Burgess is objectively false: DESC receives a single forecast at the beginning of the day from each solar facility, which means that by mid-day it is actually even greater than 4-hours ahead; when this schedule is labeled as "hourly" that is descriptive of the

granularity of the forecast not the frequency with which it is delivered. The second important reason that this suggestion is flawed is because, as previously discussed, the reduced solar forecast error that may be achieved using a 1-hour ahead forecast would not necessarily reduce the minimum operating reserve requirement for the Company. The third important reason that this suggestion is flawed is that Mr. Burgess's math is flawed. Mr. Burgess points to the NREL analysis that suggests that using a 1-hour ahead forecast of solar generation instead of a 4-hour ahead forecast can reduce solar forecast error by 40% and claims that it is appropriate to reduce the calculated VIC by the same amount. Even if it were appropriate to use a 1-hour ahead forecast in this analysis, the notion that the resultant decrease in incremental operating reserve requirements would lead to a proportional decrease in VIC is not grounded in reality. If that were the case, then it would lead that the increase in VIC that Guidehouse calculated from Tranche 1 to Tranche 2 and from Tranche 2 to Tranche 3 would be the same proportionally as the increase in operating reserve requirements from Tranche 1 to Tranche 2 and from Tranche 2 to Tranche 3; but that is not the case. Driven by a need to operate a finite system with the same thermal resources in different ways in order to meet changing operating reserve requirements, changes in system costs do not scale linearly with changes in operating reserve requirements.

Mr. Burgess's suggested VIC of $0.28/MWh is based on applying inappropriate "corrections" to supposed errors that are not in fact errors. As such, it is a meritless suggestion that should be rejected.

Q. PLEASE SUMMARIZE YOUR RESPONSE TO MR. BURGESS'S TESTIMONY.

A. Throughout his testimony, Mr. Burgess repeatedly makes false claims of deficiencies and errors in the Guidehouse VIC study. Over the course of this rebuttal testimony I have addressed each supposed error that Mr. Burgess identifies and explained in detail why Mr. Burgess is incorrect to label it as such. All of the supposed corrections to the VIC as calculated by Guidehouse that Mr. Burgess suggests are based on flawed logic and should be rejected.

REBUTTAL TO TESTIMONY OF MR. BRIAN HORII

Q. WITH RESPECT TO MR. HORII'S TESTIMONY, PLEASE EXPLAIN HOW YOU ORGANIZE YOUR RESPONSES.

A. My rebuttal testimony addresses one specific issue raised by Mr. Horii in his direct testimony.

Q. ON PAGE 8, LINES 16-17 MR. HORII STATES THAT IN HIS OPINION "GUIDEHOUSE HAS NOT JUSTIFIED THEIR FORECAST OF 16 INCREMENTAL OPERATING RESERVES NEEDED TO ACCOMMODATE SOLAR FORECAST UNCERTAINTY." DO YOU AGREE?

A. I disagree with Mr. Horii's stance here. On page 8, lines 5-6, Mr. Horii does state "[he] find[s] the overall concepts of the calculation methodology used in the 5 Guidehouse Variable Integration Study to be reasonable." Mr. Horii's objection here is not related to the methodology but rather, as indicated on page 9, lines 3-9, on Guidehouse's use of 4-hour ahead solar forecast data to calculate solar forecast uncertainty rather than 1-hour ahead. As discussed in rebuttal to Mr. Burgess's testimony, while I agree that solar forecast uncertainty would be reduced using 1-hour ahead solar forecast data rather than 4-hour ahead, the use of 4-hour ahead data in this analysis is appropriate because it better matches the data that DESC receives from solar facility operators. DESC receives a single schedule of expected solar generation from each facility at the beginning of the day, and by the middle of the day that schedule is significantly more than 1-hour ahead. If Guidehouse had used 1-hour ahead solar forecast data for this study, the solar forecast uncertainty that DESC actually experiences would have been significantly underestimated. Additionally, as previously mentioned in this testimony, the reduced solar forecast uncertainty from using a 1-hour ahead forecast would not necessarily reduce the minimum operating reserve requirement for the Company. Thus, as Guidehouse carefully considered how DESC actually operates its system currently, the most appropriate data to use and model was the 4-hour ahead solar forecast which provides the most accurate estimate of the actual integration cost incurred by DESC.

Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

A. Yes.